

On Mediterranean and New-Zealand *Reteporæ* and a Fenestrate
Bryozoa. By ARTHUR WM. WATERS, F.L.S.

[Read 1st November, 1894.]

(PLATES VI. & VII.)

OUR knowledge of the Mediterranean *Reteporæ* is most unsatisfactory, as so many specific names have been given on account of slight differences in the nature of the reticulation; and when preparing a detailed list of Bryozoa found near Rapallo*, the specimens examined in several cases did not correspond with published descriptions, so that an entire re-examination of Mediterranean *Reteporæ* seemed desirable. The reason for a more careful examination of the value of various points was increased upon receiving from Professor Parona, of Genoa, a most interesting fenestrate Bryozoa, which, at the first glance, seemed to belong to *Retepora*, whereas, upon consideration of the characters of the *Reteporæ*, it is not placed with them but described as *Palmicellaria parallelata*, though with much doubt as to whether it should not be made the type of a new genus.

The genus *Retepora* was first established on account of the anastomosing reticulate zoarial growth; but it has become quite clear that this is not a satisfactory character, since species have been found which are simply foliaceous with the zoœcial features of *Retepora*. Although our ideas of the importance of reticulation have quite changed, I maintain that we have here a natural group based upon zoœcial characters, though unaware of any one character which is absolutely constant.

The branches usually anastomose, the non-zoœcial face of the zoarium is usually relatively thick, with lacunæ in the shell-structure, and this *dorsal surface* is separated into areas by vibices; but these areas, as a rule, in no way correspond with the zoœcial divisions, whereas in *Petralia* and in what I now call *Palmicellaria parallelata* the divisions on the dorsal surface simply mark off the boundaries of the zoœcia†.

There is usually a *labial fissure or pore*, and this I should

* I hope that the results of some work done in Rapallo, near Genoa, will shortly be published, but an irritation of the eyes has caused delay.

† In the fossil *Retepora elegans*, Reuss, from the Bartonian of Italy, the zoœcial divisions are also shown on the dorsal surface.

consider one of the most important features of the genus. This pore is frequently the opening of a long tube which runs down the peristome close to the opercular opening. At one time I thought that it sometimes opened on the zoöcial side of the operculum, but I have not been able to satisfy myself that this is the case. The tube of this sublabial pore can be most distinctly seen in *Retepora fissa* (Pl. VII. figs. 21 and 22). In *Retepora Imperati*, Busk, from Porto Praya, I am unable to find it in calcined specimens in my possession; whereas in *R. Solanderia*, which is so closely related as to leave it doubtful whether it might not be placed as a variety, the pore is distinctly visible. In a specimen of *R. cellulosa* from the North Cape there are very frequently (Pl. VI. fig. 17) two such pores, one on each side.

The *ovicells* are usually raised and nearly always have a more or less fissured opening. There is the plain narrow fissure of the *R. cellulosa-fissa* group; the wide fissure of the *R.-Imperati* group; and the irregular denticulate fissure of the *R.-monilifera* group (see pl. iii. fig. 11 of my 'Challenger' Supplementary Report). In spite of considerable difference in the appearance of the ovicells in the three groups they are seen to pass through various gradations, showing in reality similarity of structure. The *R. elongata*, Smitt, however, has an entire ovicell, which when mature is either straight below or has a slight peak, as in fig. 9, while in the younger ovicells the opening is thrown much further back. The ovicells of *R. tessellata*, var. *cæspitosa*, Busk (Pl. VI. figs. 7, 8), show a similar difference in young and mature ovicells.

The *suboral glands**, to which I have called attention, seem to be well developed throughout the genus. Preparations made where there was suitable material show them in all cases; and I have now seen them in *R. avicularis*, *R. cellulosa*, *R. columnifera*, *R. contortuplicata*, *R. Couchii*, *R. denticulata*, *R. elongata*, *R. gigantea*, *R. jacksoniensis*, *R. mediterranea*, *R. tubulata*, &c.

It would seem that these glands occur quite generally through the Schizothyriata of Gregory and possibly may give us assistance in classification. I hope shortly to publish further observations on these organs, which we may have to compare with the excretory organs described by Cori in the Phylactolæmata. A form described

* 'Challenger' Supp. Rep. vol. xxxi. p. 27; and "Observations on the Gland-like Bodies in the Bryozoa," Journ. Linn. Soc., Zool. vol. xxiv. p. 272.

by Mr. Kirkpatrick as *R. sinuosa* * differs in several respects from other *Retepora*æ. The aperture and ovicell resemble those of *Lepralia*, while there are semicircular avicularia somewhat like those found in *R. granulata*, *R. producta*, &c.; the dorsal surface is vibicated, and the markings on the solid dorsal structure are independent of the zoecia. Although we may feel uncertain as to its ultimate destination, there does not seem sufficient reason at present for removing it from *Retepora*.

Another very curious form is mentioned by Mr. Busk † as existing in the Oxford Museum, differing from all known *Retepora*æ in being bilaminate. The opercula and mandibles are said to be exactly the same as those of *Retepora tessellata*. Without further examination it would be impossible to say where it should be placed. Mr. Busk proposed for it the name *R. escharoides*.

Dr. J. W. Gregory has proposed a new genus, *Schizoretepora*, for those species which have a sinus ‡, *R. tessellata* being mentioned as the type, and these in his classification are not only placed in a different family to *Retepora* but even in another suborder. Careful suggestions regarding classification, like those of Dr. Gregory, are useful as showing the direction in which attempts should be made, and our knowledge of the Bryozoa is yet so imperfect that we need not be surprised when weak points are discovered. If forms showing similarity in so many important zoecial and zoarial characters should have to be placed in two distinct suborders, there would be reason for despairing of ever obtaining a satisfactory classification, and therefore the group called *Schizoretepora* should receive our careful consideration.

This group, of which *R. tessellata* is taken as the type, includes *R. Imperati*, Busk, *R. elongata*, Smitt, *R. Solanderia*, Risso; and in all these there is apparently a small sinus, but the opercula of none have any projection on the lower border to fit into a sinus, whereas in *Schizoporella* the opercula and aperture correspond. Further examination shows that there are two teeth in the aperture of this group of *Retepora*, giving the illusive appearance of a sinus. The opercula should, however, whenever it is possible, be examined, as the shape of the aperture may in some cases be misleading, and on this account there is a certain element of uncertainty in the study of fossils. The shape of the opercula,

* Allied to *R. plana*, Hincks, Ann. & Mag. Nat. Hist. ser. 6, vol. ii. p. 269.

† 'Challenger' Report, vol. xxx. p. 114.

‡ "On the British Palæogene Bryozoa," Trans. Zool. Soc. vol. xiii. p. 224.

as figured by Busk for *tessellata* vars. and by me for what I consider a variety of *P. Imperati*, shows that there has not been a true sinus.

There is, however, another *Retepora*, the *R. formosa*, with a sinus into which the operculum fits. This belongs to the *R.-monilifera* group, and besides having the *monilifera*-form of the ovicell, has so many other minute characters of *Retepora* that it would require a good deal of courage to remove this into another genus, to say nothing of another suborder.

To return to the *R.-tessellata* group, the only member in which the sublabial pore is known is *R. Solanderia*, and here it is very distinct; while in *R. Imperati*, which so closely resembles it in most particulars, none is found. It should, however, be repeated that the existence of this pore characteristic of most *Retepora* in one member of the group may be taken as showing the close relationship to the others.

We next come to the consideration of the genus *Reteporella*, Busk, of which two species were described in the 'Challenger' Report, three by Ortmann*; then there is *R. Worsleyi*, MacG.†; and if we recognized the genus, *R. Solanderia* would be placed there also. The sole reason given for separation is that these are non-reticulate; but the three species of Ortmann approach so nearly to known *Retepora* in shape of aperture, ovicell, and other characters, that we are in doubt as to whether they should even be separated specifically. In *Retepora Solanderia* the aperture, ovicell, avicularia, &c. are truly Reteporidan, showing a very close resemblance to *R. Imperati* in nearly all particulars; and I maintain that if we placed these two in different genera on account of the one being reticulate and the other not, we should be going back to the time when almost all genera were based upon zoarial characters, and *R. Solanderia*, even if considered alone, would give sufficient reason for dropping the genus *Reteporella*.

We have seen that this species would by Busk be placed in *Reteporella*, whereas Gregory would place it and the allied but reticulated species under *Schizoretepora*. As before said, I have not seen sufficient reason to remove it from *Retepora*; and certainly, if it was found advisable to make a new genus for the

* "Japanische Bryozoenfauna," Archiv für Naturgeschichte, vol. i. 1890, p. 36.

† "Descriptions of New or Little known Polyzoa," Trans. Roy. Soc. Vict. vol. xxiii. p. 185.

R.-tessellata group, they would have to remain in the same family as *Retepora*.

The genus *Retepora* is found fossil throughout the Tertiaries, but does not seem to occur in the Cretaceous period.

RETEPORA CELLULOSA, L. (Pl. VI. figs. 17 & 20; Pl. VII. fig. 12.)

Retepora cellulosa, Smitt, *Krit. Fört. öf. Skand. Hafs-Bryozoer*, iv. 1867, pp. 35 and 203, pl. xxviii. figs. 222-225.

Although so many authors have mentioned *R. cellulosa*, there does not seem to be any satisfactory description, most having apparently had two or three forms before them; and out of the very long list of synonyms usually quoted, I cannot find more than the single one above given which can be relied upon. Such figures as those of Ellis, Lamouroux, and Blainville will do equally well for two or three species; and no doubt Busk, in his 'Catalogue of the Marine Polyzoa,' figured more than one. Quotations from such works as Lamarck's 'Animaux sans Vertèbres,' where for *R. reticulata* and the other species no single zoæcial character is mentioned, only waste time by causing useless references; and in this special case, though no doubt the figure quoted by Lamarck is that of *Fron dipora verrucosa*, it has been considered as a synonym of *R. cellulosa*. Risso describes it as "*presque membraneux*."

Out of the Mediterranean species there is one which we must now consider as the type, without being at all sure that this is the one which was in the hands of those who first gave the name. It is not a stout species, and I have not often seen it grow to any considerable size, but usually the colony is cup-shaped. The peristome is but little raised, with a spine at each corner; it has a distinct sublabial pore, which, however, seems to have been mistaken for an avicularium by some authorities, including apparently Busk in his 'Crag Polyzoa.' The operculum becomes much wider at the proximal border.

There is no avicularium within the peristome, and in this respect it differs from *R. atlantica*, Busk, and *R. mediterranea*, Smitt; but there are numerous small avicularia scattered over both the front and dorsal surface; a few large erect avicularia occur with the opening directed to the distal end of the zoæcium.

The ovicell has a fissure in the calcareous wall, which of course is covered by an integument, and is identical in structure with those of *R. Beaniana*, *R. atlantica*, *R. mediterranea*, *R. fissa*. The front

wall of the ovicell is prolonged below into a kind of lamina, subtruncate at its lower extremity, which extends some way into the aperture. This is a character which Hincks mentioned when describing his *R. prætenuis* (= *R. marsupiata*, Sm.), and is found in this group in *R. cellulosa*, *R. atlantica*, *R. complanata*, and to a certain extent in *R. Beaniana*, but not in *R. mediterranea*, *R. aporosa*, and *R. fissa*, in which last the front wall ends higher up and is straight. In *R. monilifera*, var. *munita* and *umbonata*, the front wall is prolonged in the same way, but has a cleft or sinus at the end of the lamina (see Pl. VII. fig. 20) forming a squarer opening.

The fenestral avicularium is found at the angle of most fenestræ, but not of all; similar fenestral avicularia occur in a large number of species of *Retepora* and are also found in *Petralia*. As a rule in *Retepora* they occur on the dorsal surface at the angle of the fenestræ, but they are sometimes on the front, as in *R. monilifera*, var. *munita*.

The dorsal surface has the vibices more or less longitudinal and more numerous than in *R. mediterranea*.

In a specimen from the North Cape the large erect avicularium has a distinct beak, and at the sides there are two projecting wings (Pl. VI. fig. 17). The mandible has a large *lucida*, which Mr. Busk described as a foramina; but as it is caused by the chitin being here thinner, I have elsewhere proposed the name *lucida* *. This *lucida* is figured by Busk surrounded by a second oval, as if there were a thick band; but this structure I have not found in the mandible of any, and have added a figure from a specimen sent to me from the North Cape, the mandibles of which are similar to those from Naples, Rapallo, and Capri.

Smitt placed *R. Beaniana* as "forma" of *R. cellulosa*, and certainly it is very difficult to separate the group. The oral avicularium may be at the end of a long rostrum, as in typical *R. Couchii*; it may be shorter, as in *R. Beaniana*, or within the oral aperture, as in *R. mediterranea*, or absent, as in *R. cellulosa*. Intermediate stages are found in a series of specimens, and very slight changes would evolve the one from the other. Busk speaks of a prominent rostrum having a minute avicularium on one side at the base, but this I have not seen.

* Ann. & Mag. Nat. Hist. ser. 5, vol. xx. p. 84.

RETEPORA COUCHII, *Hincks*.

From Rapallo there are specimens with large fenestræ, as in Naples specimens, and there are others with very small meshes; and, in fact, this species shows us very clearly that too much importance must not be attached to size and shape of the meshes. Usually the fenestræ are about 2 mm. long, 0·8–1 mm. wide, and the branches are 0·4 mm. wide; whereas the smaller form from Rapallo has the meshes 0·8 mm. long, 0·4–0·6 mm. wide, and one from Roscoff, sent by Joliet as "*cellulosa*," has the meshes only 0·6 mm. long and 0·2 mm. wide, with the branches 0·4 mm. wide.

Although there may be a considerable range in the size of the fenestræ, yet there is in most a typical form which should be described, and therefore the following table, prepared from specimens in my collection, may be useful for comparison:—

	Fenestræ.		Pro-portion.	Branches.
	Long.	Wide.		Wide.
RETEPORA-CELLULOSA GROUP.	millim.	millim.		millim.
R. cellulosa, <i>L.</i> ; Naples.....	1·0	0·6	1-0·6	0·6
do. Zoagli ...	0·9	0·4	1-0·4	0·5
do. N. Cape...	1·2	0·4	1-0·3	0·6
complanata, <i>Waters</i>	2·0	0·8	1-0·4	0·6
mediterranea, <i>Smitt</i>	1·6	0·8	1-0·5	0·8
aporosa, <i>Waters</i>	1·8	0·8	1-0·4	0·5
Couchii, <i>H.</i> ; typical ...	2·0	0·8	1-0·4	0·4
do. Roscoff.....	0·6	0·2	1-3	0·4
do. Rapallo ...	0·8	0·4-0·6	1-0·4 to 0·5	0·6
do. var. biavicu- lata, <i>W.</i>	2·0	0·8	1-0·4	0·4
do. do. ...	1·2	0·4	1-0·3	0·6
Beaniana, <i>King</i>	1·0	0·6	1-0·6	0·6
producta, <i>B.</i>	3·6	0·6	1-0·17	1·2-1·4
fissa, <i>MacG.</i>	1·2	0·3	1-0·25	0·6
atlantica, <i>B.</i> ; Chall.....	1·4	0·6	1-0·4	0·5
jacksoniensis, <i>B.</i>	1·4	0·6	1-0·4	0·6
porcellana, <i>MacG.</i>	1·8	0·6	1-0·3	1·2
RETEPORA-MONILIFERA GROUP.				
R. umbonata, <i>MacG.</i>	1·0	0·6	1-0·6	1·2
munita, <i>MacG.</i>	1·0	0·4-0·6	1-0·4 to 0·6	0·8
columnifera, <i>B.</i>	0·8	0·7	1-0·9	0·5
victoriensis, <i>B.</i>	0·6	0·4	1-0·6	0·8
contortuplicata, <i>B.</i>	1·0	0·6	1-0·6	0·6
columnifera, <i>B.</i>	0·8	0·7	1-0·9	0·5
tubulata, <i>B.</i>	0·6	0·4	1-0·6	0·4-0·6
formosa, <i>MacG.</i>	0·8	0·4	1-0·5	0·6

TABLE (*continued*).

	Fenestræ.		Pro- portion.	Branches.
	Long.	Wide.		Wide.
RETEPORA-TESELLATA GROUP.	millim.	millim.		millim.
<i>R. Imperati, B.; Chall. ...</i>	2·4	1·0	1·0·4	0·6
<i>elongata, Sm.</i>	4·0	1·0	1·0·25	1·0
<i>Solanderia, Risso</i>	...	...	...	0·8-1·2
RETEPORA WITH LEPRALIOD OPERCULUM.				
<i>R. sinuosa, Kirkp.</i>	1·0	0·7	1·0·7	1·5
<i>novæ zelandiæ, Waters ...</i>	0·8	0·4	1·0·5	0·8
UNCERTAIN POSITION.				
<i>R. gigantea, B.</i>	4·0	2·0	1·0	1·0
<i>magellensis, B.</i>	2·2	1·0	1·0·45	1·0
<i>lata, B.</i>	0·7	0·4	1·0·57	0·9
<i>avicularis, MacG.</i>	1·8	0·5	1·0·3	0·4

RETEPORA COUCHII, var. BIAVICULATA, var. nov. (Pl. VI. fig. 18.)

In a *Retepora* from Naples sent to me named *R. reticulata*, Lamk.*, the two prongs of the peristome each carry a small round avicularium at the end, whereas in normal *R. Couchii* the "wing-like processes" of Hincks do not bear an avicularium; on the other hand, the labial and oœcial fissures and other characters correspond with those of *R. Couchii*.

This variety I have since found in the material I collected from Naples and also from Capri, and further fossil from the Upper Tertiaries of Testa del Prado, near Reggio, Calabria, but in this case with the meshes about half the size of the living specimens.

RETEPORA COUCHII, *H.*, var. APOROSA, nov. (Pl. VI. fig. 22.)

Specimens from Rapallo have a rostrum which sometimes carries an avicularium, but more often it is merely a barren process. There is no labial fissure or pore, nor is the peristome as much developed as is usually the case in *R. Couchii*; on both the anterior and dorsal surfaces there are small oval avicularia;

* The description of *R. reticulata* given by Lamarck was quite insufficient, while the figure to which he referred represents *Fron dipora verrucosa*.

the fenestræ are moderately uniform and about the size of typical *R. Couchii*; the ovicells are turned inwards at the lower border, which is nearly straight and does not form a "lamina"; there are no oral spines; in the oral aperture there is a small denticle at each side. The operculum is very thin, and does not widen out at the proximal edge in the same way as the Mediterranean *R. cellulosa*. There are no fenestral avicularia, and the vibices are more or less parallel.

In my Supplementary 'Challenger' Report I referred to the dorsal calcareous processes of *Retepora* growing over the chitinous tubes of *Caberia*, and in the present species there are similar rooting-processes growing over fibres of seaweed, also a few such processes are thrown out from the front surface.

RETEPORA COMPLANATA, sp. nov. (Pl. VI. fig. 21; Pl. VII. figs. 14-18.)

This in most respects resembles *R. cellulosa*, but the dorsal surface is much flatter and usually has the vibices more or less parallel to the long axis of the fenestræ; and from the Naples and Capri specimens in my possession the zoarium seems to have been but little convoluted. On the dorsal surface there is a fenestral avicularium.

One piece (Pl. VII. fig. 14) has an ovicell to each zoarium, while another (fig. 18) has none, giving a remarkably different appearance to the colonies. The sublabial pore is well developed, and there is a spine at each side of the oral aperture. There is no avicularium on the lower lip, but numerous small avicularia, both oval and triangular, are scattered over the zoaria, also there are a few large raised avicularia with narrow triangular openings.

The opercula and mandibles are similar to those of *R. cellulosa*, and perhaps this should only be considered a variety.

Hab. Naples, 80 fath.; Capri.

RETEPORA MEDITERRANEA, *Smitt*. (Pl. VI. figs. 14, 15, 16.)

Retepora cellulosa, forma *Beaniana*, var. *mediterranea*, *Smitt*, *Krit. Fört. öfver. Skand. Hafs-Bryozoer*, *Vetensk. Ak. Förhand.* 1867, pp. 35, 202 note; *M.-Edwards in Cuvier, Règ. An., Zooph.* pl. lxxxvii. fig. 1 a-e (fide *Smitt*).

Retepora cellulosa, *Waters, Ann. & Mag. Nat. Hist.* ser. 5, vol. iii. p. 199, pl. xv. figs. 1, 2; *id. Trans. Manchester Geol. Soc.* vol. xiv. p. 479.

The zoarium is large, probably in most cases cup-shaped, chalky white; reticulations moderately regular; branches round; meshes about 1.6 mm. long, 0.8 mm. wide; branches about 0.8 mm. wide.

Zoëcia only slightly raised, smooth, without any large avicularia, but with a small one (with a semicircular mandible) in the aperture, and small round ones over the surface. The oral aperture is straight on the proximal end and becomes much wider towards this edge. There is a denticle on each lateral wall of the oral aperture. The dorsal surface is slightly granular and has few vibices, and these usually cross the branch near the end of the fenestræ. The ovicells as a rule are not much raised, in fact are often only recognized by the cleft.

This seems to be common near Naples and Capri, and I have it fossil from the Pliocene of Brucoli (Sicily) and Testa del Prado (Calabria). In the shape of the operculum, in having an avicularium within the aperture, and in structure of the dorsal surface it approaches closely to *R. Beaniana*, though even in these characters there is a slight difference between the two. Further the zoarium is much stouter than in the northern *Beaniana*, and the avicularium is placed diagonally within the aperture, nor is there any rostrum or avicularium, and of course the denticles projecting from the rostrum or avicularium of *R. Beaniana* are wanting.

In *R. atlantica*, B., from station 75 of the 'Challenger,' some zoëcia have a small round avicularium on the lip of the aperture, while others have a rather large triangular one, showing that too much importance must not be attached to the shape of the avicularium. I do not think this is the *R. cellulosa* of Van Beneden, which has a large erect avicularium.

RETEPORA SOLANDERIA, *Risso*. (Pl. VI. figs. 1-4.)

Retepora Solanderia, *Risso*, *Hist. Nat. de l'Europe Mérid.* vol. v. p. 344.

Retepora arborea, *Jullien* (non *Risso*), *Bryozoaires Dragages du Travailleur*, *Bull. Soc. Zool. de France*, vol. vii. p. 21, pl. xvi. figs. 49, 50.

Zoarium branched in one plane, not usually reticulated, branches thick. The zoëcia on each side of the median line have a large avicularium on a raised rounded avicularian chamber, with the mandibles directed inwards. The outer zoëcia have no avicularia, the terminal zoëcia have spines. Labial pore distinct, with a slight fissure. Ovicells cucullate, with a wide opening. The dorsal surface has regular vibices, and in each area there is a large raised avicularium somewhat similar to those upon the front, usually directed outwards, but also occurring in various positions. On the dorsal surface there is frequently at the junction of two branches a large avicularium with triangular mandibles. This is the equivalent of the fenestral avicularia

which are common in the *Reteporæ*. All my specimens were dead, and no chitinous appendages were found.

This *Retepora* is common in the material brought up from about 225 fathoms by the coral-fishers near Capri, but I have not seen it from Naples or Rapallo. It does not show any reticulation, so that if Busk's genus *Reteporella* were recognized it would have to be placed in it; but the advisability of dropping the genus *Reteporella* is clearly indicated by this species, and is quite borne out by the three species so classed by Ortmann*, as in zoœcial characters they very closely resemble known species.

Probably this is the species which Risso described with "*rameaux cylindriques nullement entrelacés*," and named *Retepora Solanderia*; but as the characters to which we should now give most attention are omitted, this is not clear.

Retepora arborea, Jullien, is described as finely reticulated on both the anterior and dorsal surface, but in all other respects the 'Travailleur' and Mediterranean specimens agree. The name *arborea* was previously employed by Risso, and therefore cannot now be used, although we cannot be sure what Risso had before him; perhaps it was *Reticulipora dorsalis*, Waters.

The zoœcial characters are in many respects the same as those of *R. Imperati*, Busk; but, as mentioned in my Supplementary 'Challenger' Report, I have not seen any reticulating *R. Imperati* from the Mediterranean, but perhaps in some cases there may be foliaceous or reticulate growth according to the conditions of the locality. The *R. Imperati*, Busk, of the 'Challenger' from Porto Praya, usually has the avicularia to the central zoœcia, and has large avicularia on the dorsal surface.

A group may be made round *tessellata* including *R. elongata* (= *R. tenella*, Ortmann), *R. Imperati*, Busk (= *R. tumescens*, Ortmann), *R. Solanderia*, Risso, which, so far as known, have a very characteristic operculum†. In this group the ovicell is widely open, more or less cucullate, and a considerable distance from the opercular aperture; in *R. tessellata* (Pl. VI. fig. 6), *R. Imperati* (Pl. VI. fig. 5), and *R. Solanderia* the opening extends far up with parallel sides, so that it has somewhat the form of a wide fissure, and we may see how from this, or *vice versâ*, the

* Ortmann, A., "Die Japanische Bryozoenfauna," Arch. für Naturgesch. vol. i. 1890, p. 36.

† The operculum of *R. tessellata*, var. *cæspitosa*, Busk, is drawn reversed in three cases in the 'Challenger' Report.

narrow fissure of *R. cellulosa* might be developed. In *R. elongata* (fig. 9) the lower edge is straighter, with a central tooth, but in the younger zoëcia (fig. 10) the ovicell has at first a wide circular opening; nor is this age difference peculiar to this species, for in many cases the opening in the ovicell is larger in the young than in the older ovicells. There are in all very large triangular avicularia on the anterior surface of the zoarium, usually directed alternately. Only in *R. Solanderia* is there a sublabial pore, very distinct; while in *R. Imperati*, which so closely resembles it in most particulars, none can be found: thus an important feature of the other groups of *Retepora* is found in one member of the present group.

The mandibles in this group are, so far as I am acquainted with them, all of the same type. They all have a round or oval part much thinner than the rest, which I have called a lucida, and this varies in size and position according to the species.

PALMICELLARIA PARALLELATA, sp. nov. (Pl. VI. figs. 11-13, 19.)

Zoarium in one plane, fenestrate, with cylindrical biserial branches, parallel to one another, and joined at more or less regular intervals by barren tubular trabeculæ starting from near the distal end of the zoëcium. Zoëcia cylindrical, distinct; surface smooth, transparent, vitreous, distal end but slightly raised; opercular aperture orbicular, operculum thin membranous, no labial pore or fissure; immediately below the aperture a long rostrum nearly the length of a zoëcium with an avicularium near the base directed outwards; mandible semicircular. Ovicell globose, prominent, slightly elongate and somewhat flattened in front, very finely pitted, with a perforation in the centre of each pit. Dorsal wall similar to the anterior, thin, transparent, smooth, showing the zoëcial walls distinctly. The zoëcia are placed alternately, and on the dorsal surface at the distal end there is a round raised disk with a round opening in the centre.

At the side of the branch where the distal and proximal zoëcia join there is a round area (Pl. VI. fig. 13, *a*), with walls sloping to the junction of the two zoëcia, and each of these walls carries a rosette plate. The trabeculæ start from such an area, so that we may say in each zoëcium there is the preparation for a trabeculum, though one is only developed to every two or three zoëcia. The external lateral wall of the zoëcium has a row of small pores.

The specimen kindly given to me by Professor Parona of Genoa was obtained in Naples, and at first sight was placed with *Retepora* and named *R. parallelata*.

Although Busk has described three species of *Retepora* which sometimes have barren trabeculæ*, they cannot be compared with the present form, and the thin shell-structure and the absence of any labial pore or fissure soon showed that it should not be placed with *Retepora*. The structure of the zoecium being so similar to that of *Palmicellaria*, it has been a question whether to call it *Palmicellaria parallelata* or to create a new genus and name it *Parallelata vitrea*; but under either name it can be easily recognized again, and its position determined when more material has been compared. The form of the ovicell is different to any that I am acquainted with in *Retepora*.

The disks on the dorsal surface (Pl. VI. fig. 11) resemble those on *Scrupocellaria*, and suggest that rooting processes may be thrown out from these disks, though I find no trace of this in my specimen †, which, though preserved in spirit, had evidently been dead some time, and there were no polypides.

Living reticulated forms are known in several genera, as *Petralia (undata)*, *Flustra (cribriformis)*, *Retehornera*, several *Idmoneæ*, as *I. Milneana*, *I. interjuncta*, *I. flabellata*, Kirchenpauer, the last three being joined by barren tubes, while *Bugula reticulata* throws out connecting tubes. In the Chalk there are several others; and when more importance was attached to zoarial characters, the *Fenestellidæ* were classed with *Retepora*, though they have now long been separated.

The zoarial resemblance of the species now under consideration to *Fenestella* will naturally strike any one. The family *Fenestel-*

* 'Challenger' Report on the Polyzoa, pt. xxx. p. 108.

† Many instances are known where these disks, or, as we may call them, radicle chambers, are found in some zoecia without any chitinous tube growing from them. In the Cellulariidæ various examples might be cited, and *Alysidium Lafontii* is a most interesting one, for these radicular disks on the dorsal surface near the distal end have been correctly figured by Savigny, Busk, and others; but no reference has been made to them, nor does the structure seem to have been understood. These disks are always present; but, after the examination of a great many specimens, I have only found the rooting-processes growing from one small specimen from Trieste and a small one from the Gulf of Taranto. Dr. A. Neviani, in the 'Rivista Italiana di Paleontologia' (April 1895), has published descriptions of two fossils from the Pliocene or post-Pliocene of the Farnesina, which he calls *Vibraculina*; and *V. Conti*, Neviani, is apparently identical with the Naples form, although in the fossil it has not been possible to make out all the structure, and the name *Vibraculina* would not be suitable, as we now see that there are no vibracula.

lidæ, according to some, only includes forms which have two zoëcia in a row, the branches being united by barren dissepiments; others would also place in the family those which have several rows of zoëcia. At any rate, our Naples specimen in these respects resembles typical *Fenestella*, but when other characters are examined we see that the striking resemblance is merely zoarial. The dissepiments are tubular, which, so far as I can make out from published figures and from specimens in my collection, is never the case in *Fenestella*; as to the value of this point we are scarcely in a position to form an opinion, whereas the differences in the shape of the zoëcium are of more importance.

In 1878 I pointed out that in one species of *Fenestella* there are two denticles in each cell *, and Ulrich, in his 'Palæontology of Illinois,' has shown that these denticles are largely found in the Cryptostomata, a suborder proposed by Vine; and to repeat what I have elsewhere said †, these denticles are usually at the base of what Vine ‡ and Ulrich § call a "vestibule,"—that is to say, there is within the shell a tubular shaft up to the external opening, so that it is at right angles to the "primary chamber," which might be called the zoëcial chamber.

There are several recent Chilostomata which have zoëcia the shape described as occurring in Palæozoic Cryptostomata, among others *Childonia Cordierii* may be mentioned, and there are some which have a hemisepta at the point of attachment of the operculum; so that there seems very strong reason for following Ulrich in considering that the Cryptostomata, including *Fenestella*, show closer relationship to living Chilostomata than to Cyclostomata. Now when we compare the shape of the zoëcia of *P. parallelata*, we find none of the characters of Cryptostomata and there are no hemisepta.

There is no affinity between *Retepora* and *Fenestella*, although with regard to zoarial characters both may be fenestrate with dissepiments, or reticulate through the branches anastomosing, while a few are simply branched.

The *Retepora deserta*, Waters, which I described || fossil from Bairnsdale, has somewhat the same structure as *Palmicellaria parallelata*.

* "Remarks on some Fenestellidæ," Manchester Geol. Soc. vol. xiv. 1878.

† Ann. & Mag. Nat. Hist. ser. 6, vol. viii. p. 50.

‡ Quart. Journ. Geol. Soc. vol. xl. p. 332.

§ "Palæozoic Bryozoa," Palæontology of Illinois, vol. viii. 1890.

|| Quart. Journ. Geol. Soc. vol. xxxviii. p. 511.

NEW ZEALAND.

The only reference, so far as I am aware, to New-Zealand *Retepora* is in Hutton's 'Catalogue of Marine and Land Shells,' &c. p. 195, where *R. cellulosa* is said to have been found off Chatham Island, New Zealand; but seeing how unsatisfactory the descriptions of *R. cellulosa* are, it may be doubted whether it has been found in the southern hemisphere.

Miss Jelly has lent me specimens of *R. fissa*, which occurs in Victoria, N. S. W., and Tasmania. Of two species of *Retepora* in my collection, both of which were given to me by Miss Jelly, one is new and the other appears to be a form of *R. monilifera*.

RETEPORA MONILIFERA, forma MUNITA, *Hincks*. (Pl. VII. figs. 7-11.)

A colony of much convoluted *Retepora* belongs to the group of *R. monilifera*, though the absence of ovicells leaves the determination somewhat unsatisfactory. The peristome is very slightly raised, there is a suboral pore, and a small triangular avicularium on the peristome by the side of the pore; besides this there are three kinds of avicularia scattered abundantly over the anterior surface—(1) a long triangular one, usually without a bar, (2) a small semicircular one, (3) a small oval one; and there is also a large semicircular avicularium near the angle of a fenestra on the anterior surface. On the dorsal surface there are small oval avicularia, and these are especially numerous within the fenestræ. The opercula are very thin, which is not the case with my Australian specimens of *munita*.

The vibices are few, meeting in the middle or crossing over the branch, and there are no dorsal fenestral avicularia.

The small avicularium on the peristome resembles those on *R. porcellana*, *R. monilifera*, *R. aurantiaca*, *R. granulata*.

Hab. Victoria; South Australia; New Zealand; and var. *japonica*, B., from Japan.

RETEPORA FISSA, *MacG.* (Pl. VII. figs. 21, 22.)

Retepora fissa, *MacG. Trans. Roy. Soc. Vict.* vol. ix. p. 140, and vol. xix. p. 291, fig. 8; *Zool. Vict.* dec. x. p. 17, pl. xcv. figs. 12-16; *Waters, Ann. & Mag. Nat. Hist.* ser. 6, vol. iv. p. 18.

Miss Jelly has kindly lent me specimens from New Zealand which Mr. Busk had named *R. maorica*, MSS., and another which

had come into her possession marked *R. Colensoi*, Busk, MSS. Both these entirely correspond with the Australian *R. fissa*, now known from Victoria, New South Wales, Tasmania, and New Zealand.

Figure 21 represents a calcined specimen from Tasmania, showing the way in which the groove of the sublabial pore forms two projections in the aperture. This can be seen in all the specimens which have come under my notice, though not in every zoecium. The square opening in the lower part of the ovicell is also shown. The avicularium is sometimes erect like that of *R. cellulosa*, and there is a triangular fenestral avicularium.

RETEPORA NOVÆ ZELANDIÆ, sp. nov. (Pl. VI. figs. 1-6 & 19.)

The zoarium is convoluted and of a pink shade, but the colour has probably faded.

The zoecia are distinctly separated, with the line of separation ending near the oral spines; surface minutely granular; no peristome; aperture in mature zoecia sunk. Oral aperture very long, crenulated; sides nearly parallel, with a very large tooth on each side, giving the appearance of a sinus. The operculum becomes gradually narrower at the proximal edge and has the muscular dots very distinct, with a thickened band below each. At the side of the aperture, about halfway up, a spine articulated at the base; on the surface numerous pores as well as a few large scarcely raised triangular avicularia. The dorsal surface has fairly numerous vibices, usually meeting between the fenestræ, and in the area of some there is a triangular avicularium, but this is exceptional, whereas within the fenestræ, or on the side of the fenestræ, there are numerous triangular avicularia.

The specimens in my own collection which I first described are without ovicells, but Miss Jelly has very kindly lent me two slides from Wanganui (New Zealand) with ovicells which are widely open, somewhat like those of *R. Imperati*, and the terminal zoecia have four to six spinous processes. One specimen has the triangular avicularium immediately below the aperture to almost every zoecium. Although the operculum is Lepralioid the ovicell is Reteporidan, and besides there are the vibices and dorsal avicularia of this genus.

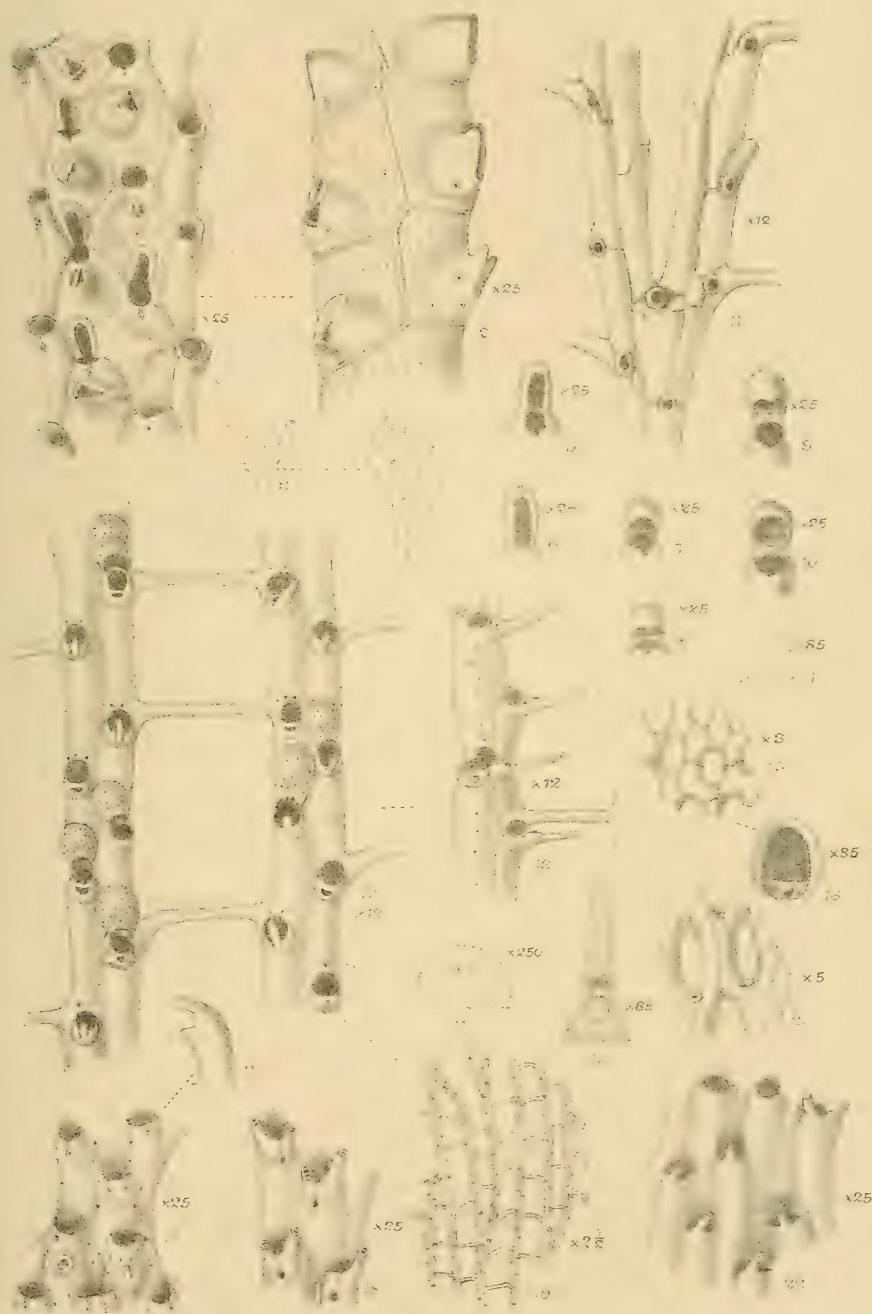
EXPLANATION OF THE PLATES.

PLATE VI.

- Fig. 1. *Retepora Solanderia*, Risso. $\times 25$.
 2. Do.; dorsal surface. $\times 25$.
 3, 4. Do. Natural size.
 5. *Retepora Imperati*, Busk; ovicell. Porto Praya. $\times 25$.
 6. *Retepora tessellata*, Hincks; ovicell. $\times 25$.
 7. *Retepora tessellata*, var. *cæspitosa*, B.; young ovicell. $\times 25$.
 8. Do., do.; older ovicell from the same colony. $\times 25$.
 9. *Retepora elongata*, Smitt; ovicell. $\times 25$.
 10. Do.; younger ovicell from the same colony. $\times 25$.
 11. *Palmicellaria parallelata*, sp. n.; dorsal surface. $\times 12$.
 12. Do.; anterior surface. $\times 12$. (a) mandible.
 13. Do.; turned somewhat sideways to show the suboral rostrum.
 14. *Retepora mediterranea*, Sm.; operculum. $\times 85$.
 15. Do.; dorsal surface. $\times 3$.
 16. Do.; oral aperture, showing small avicularium. $\times 85$.
 17. *Retepora cellulosa*, L. North Cape. $\times 25$. (a) avicularium.
 18. *Retepora Couchii*, var. *biaviculata*, var. nov. Rapallo. $\times 25$.
 19. *Palmicellaria parallelata*, sp. nov. $\times 2\frac{1}{2}$.
 20. *Retepora cellulosa*, L.; North Cape; mandible. $\times 85$.
 21. *Retepora complanata*, sp. nov.; dorsal surface. $\times 5$.
 22. *Retepora Couchii*, var. *aporosa*, var. nov. $\times 25$.

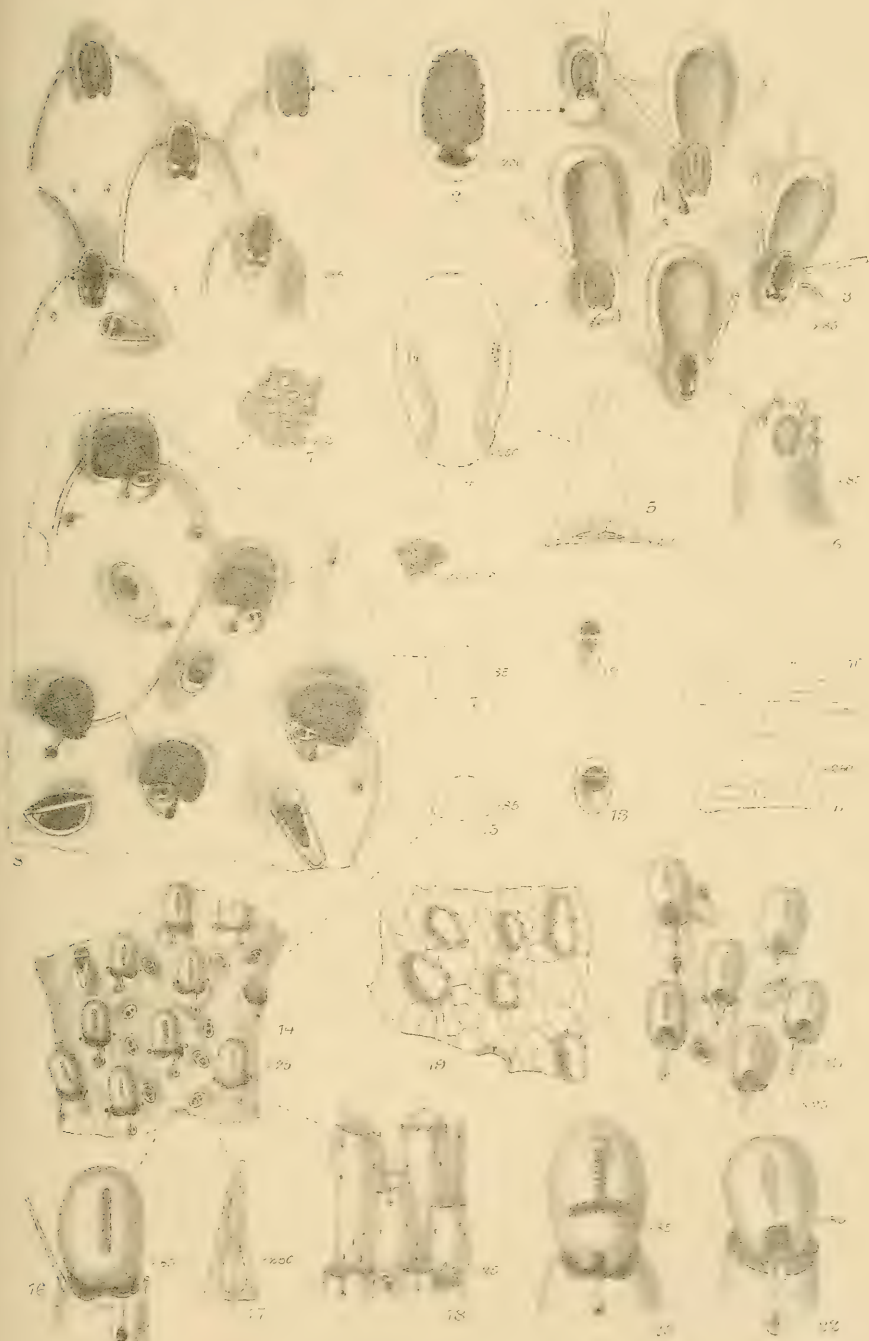
PLATE VII.

- Fig. 1. *Retepora novæ zelandiæ*, sp. nov.; without ovicells. $\times 85$.
 2. Do.; aperture after the operculum has been removed.
 3. Do.; with ovicells. $\times 85$.
 4. Do.; operculum. $\times 250$.
 5. Do.; mandible. $\times 250$.
 6. Do.; young zoecium. $\times 85$.
 7. *Retepora monilifera*, var. *munita*, MacG. $\times 2$.
 8. Do., do. $\times 85$.
 9. Do., do.; operculum. $\times 85$.
 10, 11. Do., do.; mandibles. $\times 250$.
 12. *Retepora cellulosa*, L.; avicularium.
 13. *Retepora Beaniana*, King; avicularium.
 14. *Retepora complanata*, sp. nov.; with ovicells. $\times 25$.
 15. Do.; operculum. $\times 85$.
 16. Do.; ovicell. $\times 85$.
 17. Do.; mandible. $\times 250$.
 18. Do.; without ovicells. $\times 25$.
 19. *Retepora novæ zelandiæ*, sp. nov.; dorsal surface. $\times 5$.
 20. *Retepora monilifera*, var. *munita*, MacG.; Victoria; ovicell. $\times 85$.
 21. *Retepora fissa*, MacG.; Tasmania. $\times 25$.
 22. Do.; ovicell. $\times 85$.



A.W. Waters del.
A.T. Hollick lith.

West Newman imp



AWWaters del.
A.T.Hollick lith.

West, Newman imp